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ABSTRACT

This conference presentation discusses the place, framework, and importance of establishing a national database of academic talent in mathematics, science, and technology. A vision of such a database is presented, in which educators and researchers are urged to transform rationales for research from the reactive toward the active, to turn from a rhetoric of desperation toward opportunity and enriching challenges. The talent search process, conducted through regional programs at Duke University (North Carolina), Johns Hopkins University (Maryland), University of Denver (Colorado), and Northwestern University (Illinois), is described, along with the electronic databases being used and the database contents. A confederation of the four talent search programs is called for, with the responsibility to develop: a reporting system; policies and procedures for location, staffing, and governance; and a mechanism for regulating use of data. A discussant reaction by Robert Thompson notes that the national database is not the end point, but an essential vehicle for accomplishing the goals of guiding the harvest of talent and evaluating its yield. Several critical questions in developing a conceptual framework for such a database are outlined. A second reaction by E. James Maxey describes how microcomputer technology could be used to achieve the goals of the national database. (JDD)

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PURCHASE AND POSSESSION: A NATIONAL DATABASE
FOR THE SCIENTIFICALLY, MATHEMATICALLY AND
TECHNOLOGICALLY TALENTED

Robert N. Sawyer

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In 1803, a mixture of good fortune, national security issues, foreign entanglements, and American interest in frontier expansion conspired to bring about the Louisiana Purchase, which (as we know from our second grade teachers) doubled the national domain. The territory had excited President Thomas Jefferson's imagination for at least the twenty years before he pushed for the purchase--and then not merely on imperialist grounds, though of course such considerations also came into play. Jefferson thought at one point that prehistoric mammoths might still be alive somewhere in the reaches, and he had heard that its wilderness contained a mountain of pure salt. In 1803 the ink had dried on an agreement--\$15 million for a largely mysterious chunk of North American real estate. To dispel some of the mystery, on June 20, 1803, President Jefferson charged Meriwether Lewis "to explore the Missouri river, & such principal stream of it, as, by it's course & communication with the waters of the Pacific Ocean, may offer the most direct & practicable water communication across this continent, for the purposes of commerce." Jefferson's charge reflects a continental vision.

Surveying longitude and latitude were primary interests in this expedition, but Jefferson also included strategic objectives: "The commerce which may be carried on with the people inhabiting the line you will pursue, renders a kno[w]ledge of these people important," Jefferson wrote, giving Lewis the task of scouting out the native customs, lands, possessions, language, monuments, various "ordinary occupations," and "moral & physical circumstances which distinguish them from the tribes we know." --In short, the President required intelligence for businessmen, armies, and diplomats. And yet, Jefferson was also himself a naturalist and America's "Renaissance man," as his keen interests in "philosophical" (by which he denoted what we term "scientific") pursuits of the voyage reveal: "Other object worthy of notice will be the soil & face of the country, it's growth & vegetable productions; especially those not of the U. S. the animals of the country generally, & especially those not known in the U. S. the remains and accounts of any which may deemed rare or extinct; the mineral productions of every kind [. . .] Volcanic appearances. climate as characterized by the thermometer, by the proportion of rainy, cloudy & clear days, by lightning, hail, snow, ice, by the access & recess of frost. . . ."

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The Lewis and Clark Expedition has its authentic historical worth not because it marked the first footsteps of white men upon the inner ground of the American continent, but because of the information it brought back to the "familiar" lands of the Eastern seaboard. Meriwether Lewis and William Clark were not the first to make a transcontinental voyage--Alexander MacKenzie had preceded them in fact--but their voyage was documented and "philosophically" authoritative. In the Lewis and Clark Expedition, the territorial fact of the Louisiana Purchase is transformed into an American natural resource. The expedition itself was the act of possession; the possession itself was the knowledge.

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The differences between the Jeffersonian America and today's America are obvious. Long ago we reached the western shores, and we have already experienced the implications of our "Manifest Destiny." We know the blessings of the natural riches of Jefferson's Louisiana Purchase. But where Jefferson's America faced a physical wilderness, we today face a wilderness of economic and technological challenges. Our challenges are no less daunting, though they apparently draw less on military cunning, Indian diplomacy, and physical endurance. We now confront an age when our national expansion will be articulated in more rarified terms—in the vocabularies of knowledge, technical ability, and inventiveness. It may even be the case that such scientific and technical abilities will press man beyond the geography of this world and on to a newer and more spacious frontier—the heavens. America at the beginning of the nineteenth century had advantages that no other nation had in the recorded history of man—it had an open backyard with natural riches. But America has stepped into the situation of every other modern society. Now, we are faced with the dilemmas and the physical restrictions of the so-called "Old World," and our society has matured from its "New World" infancy. As John Gardner wrote, "The demand for talent is an inevitable consequence of our stage of development as a society. . . . It is not a new trend. We can observe societies in the world today at every stage of development from the most primitive to the most advanced, and nothing is easier to demonstrate that every step toward the latter involves a heavier demand for educated talent" (Gardner, 1961, p. 36). In a sense, Lewis and Clark had it easy, for their challenge had a certain deadly simplicity in the meeting of an infant America and the unformed wilderness of the Louisiana Purchase.

The relationship of a nineteenth-century expedition and a twentieth-century social research task may be a bit fuzzy. I do, indeed, wish to talk about the place, framework, and importance of establishing a national database which could be vital to the current and longitudinal knowledge of academic talent in mathematics, science, and technology; but I also think it would be an abuse of the spirit of this conference merely to focus on the specific details of such a database, as if the techniques of data collection were self-justifying. And so, I think it is important to approach that research task with an informing vision—a vision, I believe, which arises from the peculiar history of the Louisiana Purchase, which is virtually the history of an American continent. We have tended to justify our research in scientific, mathematical, and technological talent with the rhetoric of invasion and desperation—through our work we seek to dam a "rising tide of mediocrity" or keep our children from becoming "stragglers in a world of technology" or work to prevent the extinction of an American "industrial dinosaur." I think that it is time to transform our rationales from the reactive toward the active, to turn from extinction and desperation toward opportunity and enriching challenges. Our nation has "signed the agreement," so to speak, for a Louisiana Purchase of human talent by centering its attention in a significant way on the educational preparation of its children; and, in a sense, the fact that this Talent Identification Program/National Science Foundation conference has come to pass is evidence of that "agreement." However, the claiming of human talent and human resources comes with what goes on after the "agreements" are signed—when we send our own Lewises and Clarkes into the newly purchased wilderness to scout out what riches, what opportunities, and what perils are held within it.

Our twentieth-century Louisiana Purchase is our commitment to educate for future prosperity; our expeditions into that raw opportunity will inform us and

allow us to "take possession" of the human resources of our nation. John Curtis Gowan used a related (though violent) wilderness metaphor when he said to those attending the Seventh Annual Hyman Blumberg Symposium on Research in Early Childhood Education: "Heretofore we have harvested creativity wild. We have used as creative only those persons who stubbornly remained creative despite all efforts of the family, religion, education, and politics to grind it out of them, in prosecution of which men and women have been punished, flogged, silenced, imprisoned, tortured, ostracized, and killed. . . . As a result of these misguided efforts, our society produces only a small percentage of its potential of creative individuals, and they are the ones with the most uncooperative dispositions. If we learn to domesticate creativity—that is, to enhance rather than deny it in our culture—we can increase the number of creative persons in our midst severalfold" (1977, p. 22). Gowan's militance and passion are apparent and, perhaps, a bit affronting, but the point is made. If we wish to prosper, we must possess the wilderness and purposefully derive from it what we have up to now only haphazardly found in our midst. To do that we need to know what's there, and we need to determine the factual basis of the stories of mountains of salt or living mammoths in the midst of the wilderness. We need to answer questions and dispel myths.

The need for national research on the topic of academic talent came especially clear to me in 1983, when the Children's Caucus Policy Forum of the United States Senate invited five TIP youngsters and me to tell them about ourselves and what we do and need. My colleague Greg Kimble was my proxy as it finally turned out, since I was trapped in an airplane on a foggy runway in Philadelphia. Later, my good friend Bill Bevan said to me that anyone who knows anything takes the train from Philly to Washington. How was a farm boy to know? The Senators had a number of questions—which of course Professor Kimble and the students ably fielded. After the fog cleared in Philadelphia and I arrive for only the final moments of the testimony, Professor Kimble and I later talked in sunny Durham about the testimony and the questions, only to find out that our safest and most informed responses had meaning largely within the sixteen-state region TIP serves. That point is, indeed, unsurprising; but its implication still is foreboding: *Our knowledge of academic talent is limited not only by the scarcity of research funds but also by the very institutional focuses of the universities doing the research.* There is no single and reliable place where information on our nation's talent can be procured. And even when information is teased out of the variety of researchers, the resulting picture is a crazy quilt of information, informed by different methodologies and shaped by different research assumptions. Variety is rich, but the information necessary for sound national public policy on the development of academic talent sorely lacks.

To use Jefferson's delusion as an analogy: We can still easily believe that mammoths still survive in the wilderness of talent. But what if policies were to be shaped around their existence?

Initial Explorations: The Terman Studies

In 1921, Lewis M. Terman initiated the prototype longitudinal study of the gifted, and his data has been a very rich source of information over most of the century. He began by identifying 1528 students aged 8 years and older with IQs of 130 or greater and creating a database incorporating numerous variables. The

group initially completed inventories on their academic and social activities and a test of moral character. Parents provided information on the home environment, and teachers reported on the physical, academic and social life of the child at school by drawing on observation and school records. This compilation of different kinds and sources of data has increased our understanding of many of the relevant features of academic precocity, its psychological vulnerabilities and resilience, and the life and career achievements of those blessed with an intellectual gift. Societal changes, methodological advances, and even the knowledge derived from these studies themselves have rendered the data from the original study in some ways incomplete. Terman's study raised many questions which the data could not respond to.

Terman and his colleague Melita H. Oden believed that the selection of subjects for the study ensured "that the group selected for study constituted a reasonably unbiased sampling and that whatever traits were typical of these children would be reasonably typical of gifted children in an comparable school population" (Terman and Oden, 1959, p. 53). The "comparable school population" chiefly fit "the public schools of the larger and medium sized urban areas of California (Oden, 1968, p. 5). It is worth bearing in mind that the initial identification instrument was the 1916 Stanford-Binet Intelligence Test (largely a revision done by Terman himself), followed by the Terman Group Test of Mental Ability, which provided the norms to make sure that participants scored in the top 1% of the general school population. With our healthy suspicion of the implications of intelligence testing, we might suspect that aspects of the Terman study are as much about the 1916 Stanford-Binet and the Terman Group Test of Mental Ability as they are about the 1528 subjects who were studied.

Follow-up contacts in the Terman study were conducted at an average of five-year intervals, alternating between field contacts and by-mail contacts. Terman's field contacts occurred in 1927-28, 1939-40, and 1950-52; by mail contacts occurred in 1936, 1945, 1955, and 1960. Robert Sears and Lee Cronbach did another followup survey in 1972. Subsequent study has also been conducted on the Terman group, who are otherwise known as "Termites," by Robert Sears, Pauline Sears, Ann Barbee, Lee Cronbach and others. The study was well maintained. Oden wrote in 1968 that the "extent to which contact with the subjects has been maintained is unequalled for longitudinal studies. In the course of the investigation only 26 subjects (10 men and 16 women) have been lost track of entirely" (Oden, 1968, p. 6). In the field studies, about 95 percent of the subjects participated.

The Terman study is to be praised for its rich basis and careful administrative preservation, but the study has its boundaries, as do all human endeavors. And in its shortcomings lie the most vexing and pressing issues of today's research into the academically talented. One of the things that Terman did not do is precisely what most of us in this room wish to do—intervene at some point in order to foster talent, to guide and enhance the resources of our talented citizenry. Terman's passivity in this regard could have come from his early conviction that talent (his term is "giftedness") is an unalterable hereditary attribute. He found that the "Termites" maintained their intellectual advantage through the course of the study, as determined by Concept Mastery tests administered as part of the field studies. The characteristically descriptive tone of the literature produced from the Terman studies falls out of that belief, for

Terman's idea of "causality" in the acquisition of talent was prefabricated, so to speak, by the fact of nature. Terman and his associates likely felt that the causes of success were so apparent in the descriptions of "giftedness" and the fact of IQ scores that they needed little other speculative or theoretical basis. It is no coincidence that his work, and that of his successors, appeared in a series called *Genetic Studies of Genius*—a series, incidentally, that Terman founded at Stanford. Terman recognized his kinship with Francis Galton, even though he felt a greater personal tie to Alfred Binet for his "insight and openmindedness, and his rare charm of personality" (Boring, 1959, p. 331).

Nevertheless, simply to brand Terman a genetic determinist is also to misapply a label. Certainly, in 1932 he wrote: "That the major differences between children of high and low IQ, and the major differences in the intelligence test scores of certain races, as Negroes and whites, will never be fully accounted for on the environmental hypothesis" (Terman, 1932, pp. 329-330). Those are the words of a determinist, and we would probably also include the label "racist" as well. But these words from 1932 were reconsidered in 1951, though regrettably not in public form. Terman's own copy of the book in which the words appeared (his autobiography) strikes this sentence and includes the marginal comment: "I am less sure of this now in 1951 than I was then." The certainty of genetic inheritance evidently waned over those interceding twenty years.

Early prejudices and hunches did set the mold for the Terman longitudinal study. Socioeconomic status factors (which Terman would probably have set within the bounds of the "environmental hypothesis") were not controlled in the study, and the study did little to investigate or control ethnicity. These two holes in the Terman study are probably among the most interesting for researchers in academic talent today, and yet in response to these problems today's researchers have conducted miniscule longitudinal studies in comparison with the efforts Terman and his colleagues mounted. Money, quite frankly, is a major impediment today, as it was in Terman's day as well. Terman did have test royalties, though, and those resources provided for more than a half of the approximately \$250,000 it took to do his study. I know of only a few researchers today who would invest so much of their own money into a project, and I know of no plans for any major longitudinal study that would require only a quarter million dollars to conduct.

Virgil Ward said that "we should constantly remind ourselves that Terman himself spoke of his research as being a 'prolegomenon' to education; and that science is advanced by alternating transactions between controlled investigation and reflective imagination" (Getzels, 1977, p. 258). A new and ambitious longitudinal study of academic talent should follow that spirit. Although Terman did not initiate much beyond his "prolegomenon," our contemporary efforts should have in mind the implications of, and practices deriving from, basic knowledge. Especially in education, we have a social and also a scientific agenda. We seek to know so that we can educate; we educate so that we can empower; we empower so that we may live justly. Our emerging longitudinal studies of all facets of academic talent must squarely face what Terman skirted: the centrality of socioeconomic factors and the "environmental hypothesis" that comes into play when the facts of nature meet the concrete realities of everyday life.

The Equipment of Today's Expedition: Regional Talent Searches

Records show that Lewis and Clark equipped themselves with what must have been a mountain of sundry articles, including, oddly enough, a heap of pewter spectacles, and a gross of shower curtain rings—provided, we are told, as ornaments for Indian ears, fingers, and noses. Lewis was particularly pleased by an iron boat frame, light-weight enough for ease of transport and collapsable at that. All you add is a birch-bark sheath. With these supplies, the party left St. Louis to wander and observe, scouting out what a wilderness had as resources.

The analogy I have set up between a national and perhaps longitudinal database and that nineteenth-century expedition, without a doubt, borders on the "metaphysical." But, at the risk of no little humor, I wish to exchange equipment, as it were, with Lewis and Clark. We have already at our disposal the guidance of Terman and his successors (a scientific group acting as our Sacajawea), and we have a group of loosely coordinated and cooperating regional talent searches located at Duke University (Talent Identification Program—TIP), The Johns Hopkins University (Center for the Advancement of Academically Talented Youth—CTY), the University of Denver (Rocky Mountain Talent Search—RMTS), and Northwestern University (Midwest Talent Search—MTS). Incidentally, the directors of these regional searches are all attending this conference. The organizations at these universities have taken responsibility for conducting annual talent searches using the same basic model which was developed by Julian C. Stanley at The Johns Hopkins University, though the search process varies greatly in size and details. The searches cover the entire United States in geographical regions agreed to by each organization. Basic information collected by the searches is matched with additional information requested from applicants, so at the completion of each search year, a basic profile of talent search applicants is available for the "instant" of their middle school years.

Each of you attending this meeting likely as not already understands the form of the talent search process, and so I will not dwell too long on its particularities. In brief, the talent searches invite seventh-grade students scoring in the upperthree percent on a nationally-normed achievement or intelligence test to apply. These applicants sit for the Scholastic Aptitude Test (SAT) or, beginning this past year through the Talent Identification Program, the American College Testing Program's ACT Assessment. The experience of the search organizations over the years has shown that the out-of-level SAT provides meaningful measures for academically talented students and is a reliable predictor of success in high-level and fast-paced academic programs specifically designed for extremely talented youth. Research conducted so far on the ACT suggests that it is not greatly unlike the SAT in those respects. The participants in the talent searches in general perform nearly as well as college-bound high school seniors, and many outperform their older fellow test takers. Many have scored in the upper 700s on the SAT-M and SAT-V, and a handful have scored "perfect" 800s on the SAT-M. Many students have performed at the upper end of the ACT score spectrum. The group of students has at the outset a more specific profile than Terman's 1,528 individuals had, for although the Stanford-Binet which Terman used was perhaps then the best single instrument for determining intellect, it is nonetheless a *global* composite. The SAT and, we believe, the ACT provide more specific information

about intellectual ability in more specific domains, making it easier from the outset to estimate aptitude by area of knowledge (See Stanley, 1977).

The extant electronic databases at TIP and CTY alone have an estimated combined size of about 400 million bits of information, with each program collecting an additional 20 million bits of information yearly (about 8,000 typed manuscript pages). The data collected by the Denver, Duke, Johns Hopkins, and Northwestern programs comprise a common base of information, but despite the common elements, differences in wording and emphasis exist. This fact makes simply merging the existing databases difficult and, in some areas of interest, impossible. The databases contain attitudinal, demographic, achievement, and motivational information on students, as well as information on characteristics of their families and schools. Most importantly, the vehicle for annually collecting common data from more than 110,000 students in all fifty states currently exists.

More specifically, the databases contain the following basic information:

- *Student identification information* including name, address, and telephone number as well as the name, address, and telephone number of another relative who is likely to know the future whereabouts of the respondent;
- *Family composition* including the number and age of parents, siblings, and the presence of twins;
- *Respondent's grade and age;*
- *Parent's education, job status, and job title;*
- *Ethnicity;*
- *Academic attitudes* including like or dislike of school in general and of specific subject matter, such as science and mathematics;
- *Method of learning, background in, and acceleration* in mathematics, science, humanities, social studies, and languages;
- *Participation in individual and group learning activities*, science fairs, and gifted programs;
- *Preferences regarding college major;*
- *Preferences regarding which college to attend;*
- *Occupational preferences;*
- *Means of becoming aware of the respective talent searches;*
- *Interest in science, mathematics* and a variety of other academic offerings;
- *Age-normed performance scores* as measured on one or more nationally standardized test(s) [see note 7];

- *Out-of-level/age performance "achievement" scores as measured by the Scholastic Aptitude Test or the ACT Assessment; and,*
- *For the many respondents having taken the SAT on multiple occasions, multiple scores and the date of test administration.*

In addition to the basic annual data collections, TIP, CTY, MTS, and RMTS have each conducted special purpose surveys and research efforts in select subpopulations derived from the programs' individual talent search pools. While the TIP efforts have focused on cross-sectional research issues, several studies have been of a longitudinal nature. The TIP studies are diverse, including such specific programmatic and basic research as:

- *Course performance measures for academic program participants used, in part, to gauge teaching effectiveness. The battery of measurements of knowledge gain and mastery includes 1) pre- and post-measures on standardized or instructor designed exams, 2) pre-course diagnostic exams and post-course standardized tests, and 3) performance measures relative to other participants.*
- *Measures, focusing on academic and social satisfaction with the program. We have sought to identify potential mediators and motivations students have in the academic and social aspects of the academic programs, and we have used this information in evaluative studies as well as in prediction of academic performance in the summer residential program.*
- *A longitudinal study with five cohorts of academic program participants designed to identify immediate and deferred outcomes of involvement in the educational programs.*
- *Standard measures of intelligence, perceived competence and early psychological and behavioral development have been collected from cross-sections of three groups: 1) academic program participants, 2) equally qualified talent search participants who did not participate in academic programs, and 3) similarly aged youth from public schools. We conducted this research in order to investigate the nature and course of development of academic talent; and*
- *Assorted personality measures (e.g., CPI profiles) have been collected on select cross-sections of talented students and comparison students in order to identify personality traits which can help to distinguish the populations.*

While data for these individual projects have been computerized, we have not completed tying the various TIP databases together to make them into the larger talent search database (though we hope that this will be accomplished by April, 1988). Lack of both time and financial resources has relegated these tasks to a relatively low priority. Up to now our research efforts have dealt with specific programmatic issues or have consisted of easily accomplished basic research.

The brief description of the database contents--in however many individual files--shows that the information already collected is substantial and could form a

sound foundation for future basic and applied research. I suspect a similar statement could be made regarding the other talent searches. There are, however, improvements that can significantly increase the usefulness of the databases, some of which have been instituted at TIP. Since 1987, participants have provided their Social Security numbers to simplify the merging of data into the database. Incidentally, with the 1986 Tax Reform law, youngsters who are claimed as dependents must have Social Security numbers by their fifth year. Although in 1988 about 70 percent of TIP's talent search applicants supplied Social Security numbers (a fact which itself has some significant implications), we expect that nearly 100 percent will do so in future years. Three other significant additions were made in the annual questionnaire in 1987:

- We began to request additional demographic data about housing characteristics, including noise level in the home.
- We first included brief measures of personality characteristics, including self-concept, motivation, and adjustment items as they relate to academic and social activities.
- We started to collect information on environmental characteristics with a truncated age-appropriate life events scale and an inquiry about current and past health.

TIP's current questionnaire has developed from an initial questionnaire circulated in 1981. Although the present TIP questionnaire does cover similar points as this initial protocol, it has been considerably expanded and refined. We expect this process of revision to continue at TIP, as it will no doubt continue at the other regional searches. And for that reason, as with isolated populations of living things, evolutionary distinctions will arise among the data-gathering instruments of the individual talent searches, a fact which will probably make large-scale research collaboration increasingly difficult. A national database would not halt the evolutionary improvements in such research protocols as annual questionnaires, but it would coordinate and make such development methodical and self-conscious across the nation. And, indeed, a national program to supply the information to the database should *not* squelch the individual research agendas of each talent search organization. TIP's talent search region, for instance, has certain demographic characteristics that other searches do not have, and our organizational interests--including research--justifiably play on those distinguishing characteristics. Moreover, we all recognize that research staff members have their own peculiar research strengths and interests. A nationally dictated or overly centralized research agenda would make everyone play to same tune--and the harmonies of scholarship would probably wane. And, conversely, the absence of coordinated effort encourages redundancy and inhibits the kind of scholarly exchange that encourages individual accomplishment and insight. We need to find a mechanism that will optimize both the resources of basic information and the energies of those who will make sense of it.

The strength of talent search numbers and the research staffs would be strengthened by comprehensibility of research on its individuals. The numbers alone are formidable: this year TIP received about 46,000 applications, CTY nearly 36,000, the Midwest Talent Search 25,500 and the Rocky Mountain Search 4,500. A national database should supply a core of data for use in comparison and in

founding general characteristics of talent, but it must in any case preserve the peculiar identities of the researchers who use its information. To use the expedition metaphor again: we could, with a correct measure of external guidance and data sharing, all be looking at a different portion of a wilderness with a mind to create a coherent map of its resources and characteristics. This map could then be used by all who chose to do so.

Ways and By-ways: Points of Governance and Coordination

To find the correct measure of guidance and sharing, we can probably best begin with what may appear to be details. We can most easily work together to determine 1) the variety, number, and length of assessment devices that can responsibly be administered, 2) a possible research agenda or even a series of possible agendas, even if only in a brief outline format, which could efficiently use the proposed database as a cornerstone, and 3) the feasibility of funding various stages of the project. There is little practical sense in development if there are no resources for implementation.

Of course, each of these three points acts upon one another. Topics of research will influence the development of core questionnaires. And certainly, special interest studies will in all likelihood guide both the instrumentation and timing of data collection. The talent search questionnaire as a genre, if I may use a literary term, has its own limitations and strengths which good research projects will inevitably use to their advantage. Several topics for investigation have already been suggested by Janos and Robinson (1985), among others, and by TIP, CTY, MTS, and RMTS talent search and research staffs.

Of particular interest is longitudinal research on nationally representative samples of mathematically/scientifically/technologically talented youth. Longitudinal research projects could study the nature and effects of mathematical and scientific talent across the entire life span. At present there is no such database and consequently no clear understanding of mathematical and scientific talent within a developmental context. Here, specific topics of interest might include:

- *Developmental pace, milestones and progress* of individuals identified as academically talented compared to competent individuals;
- *The relationship of intellectual functioning, personality characteristics and social adaptation;*
- *The determinants of educational and vocational choice and success* among academically talented children. Here, the study of sex differences in choice and later success may be particularly important;
- *Stress and development of coping strategies;*
- *The impact of select environmental and educational intervention strategies.*

Other options include studies of cognitive functioning, studies in the selection of careers in science, mathematics, and technology, studies of leadership, comparison of identification by means of SAT or ACT with other identification

mechanisms, short-term evaluation of educational or social interventions, and studies of sex differences or racial and ethnic differences.

By establishing both a tentative research agenda and tailoring annual assessments to obtain as much of the necessary baseline data as is feasible, many research efforts could be completed quite quickly, and research on topics beyond the immediate scope of the general database will be able to use the resources nevertheless to localize and control groups to study.

It should be apparent by now that if a truly national database and a coordinated research agenda is to come into being at least a loose confederation of the four talent searches will need to come about. And, as I am a realist in matters of governance (heaven forbid!), I realize that in university communities the looser the confederation, the better. I will not discuss my thoughts on the make-up of such a governing body--the time of such a "constitution" has not yet come--but I will share my views on what seems most in need of governing.

Reporting system. A national database is little more than a collection of easily accessible information, distinguished from a card file in your basement or your tax record file only by dimension. As we all know from our tax filing forms (at least those of us who still have time and patience enough to figure them out ourselves), the more information, the greater difficulty is maintenance. At tax time, there are always a few undocumented receipts and notations which once made sense but do no longer. In a national database for mathematical, scientific, and technological talent, the problem is multiplied as each bit of electronic data is added. I know this from experience, for as our database grew to nearly 250,000 names over eight years, so also did nagging programming and formatting inconsistencies. What was in 1984 merely a "character" turned in 1985 into an "integer"; and, unfortunately, the two do not mix well in SAS. Procedures for adding and modifying data are the most basic and most pragmatic service of a governing body. It almost goes without saying that the group of cooperating organizations should standardize agreed upon "baseline" data assessments in their talent search questionnaires.

Location, staffing, and governance. Locating the "place" of the data should be carefully studied, though some location characteristics come immediately to mind. The area should be in close proximity to major research centers in education, science, and technology so that it could easily draw upon the expertise of the scientific and academic community. Facilities for optical scanning should be accessible and the area must already be considered a major computing center. Perhaps the database organization could be part of a constellation of activities drawn together under a larger "national center" for academic talent, conceived in terms of the education bill recently passed in both houses and now in conference committee in Washington. The database center will doubtlessly require significant space and full-time staff, including programmers, researchers, a project director, and numerous other professional staff. Governance for the overall organization should not be confined to the educational establishment or to those who claim to concentrate on "gifted education." Rather, a board of directors should comprise researchers, policy makers in both state and federal government, industry leaders, those with experience in the development and management of large databases, along with those of us charged with conducting the annual searches and collecting the data.

Mechanism for regulating use of data. Pragmatic considerations always imply ethical considerations, for what can be done may not always be what *ought* to be done. We collect data in trust, and it is absolutely essential that our use of that data accords with that trust. I believe that the best form of regulating uses of data is to structure inadequacies into it, allowing the masks and veils to be put aside after that which they cover is shown not only to be useful for the immediate topic of study but also necessary and within the moral bounds that are placed on it when we establish consent agreements. This data, for example, can be misused in admissions offices, government offices--local, state, and federal--and in offices of development; since it is placed into the hands of researchers for the sake of research, the data must remain within that scholarly frame of reference. Data must remain confidential and anonymous except to those in charge of maintaining the database.

I believe that a phased coordination of the talent searches would be most practical, beginning with the collaboration of TIP and one other regional search with an eye toward eventually including all regional searches. Perhaps TIP and CTY could start because their databases are probably most similar. Over a period of three to five years, these programs should be able to:

- *Link the development of talent search questionnaires* to bring about compatibilities of baseline data;
- *Establish a board of peers* to evaluate proposals seeking to use jointly maintained data, to set up guidelines for smooth coordination of data merging and entry, and to regulate access of data by stages according to the needs of bona fide researchers;
- *Provide timely national reports on database contents*, especially as it relates to science and mathematical talent, ethnicity, geographical region and community type, school type, and other factors of SES;
- *Expand and direct talent search questionnaires* to address research topics of national concern and to meet specific needs of special collaborative research as it arises.

These points seem to me to be in roughly chronological order, though the rigor with which each item is put to use should also intensify over time. The primary aim, of course, is the acquisition of new and useful knowledge; the secondary (though closely related) aim is to intensify research collaboration.

* * *

I introduced this discussion with a wilderness metaphor, and it seems appropriate--if for no other reason than symmetry--that I close it with the wilderness. The words are Robert Frost's, and they are close to my heart:

The woods are lovely, dark, and deep,
But I have promises to keep,
And miles to go before I sleep,
And miles to go before I sleep.

We do, indeed, have promises to keep, and we have "miles to go" before we have entered the new purchase of creative human talent.

Notes

1. See the National Commission on Excellence in Education's 1983 report called *A Nation At Risk: The Imperative for Educational Reform* (Washington, D. C.: U. S. Government Printing Office, 1983) and the National Science Board Commission of Precollege Education in Mathematics, Science and Technology's *Educating Americans for the 21st Century*, 2 vols. (Washington, D. C.: National Science Foundation, 1983). It is worth noting that the survivalist rhetoric has been around for some time. Sidney L. Pressey's "Concerning the Nature and Nurture of Genius," *Scientific Monthly* (1955) 81: 123-129, opens with the comment, "It has been well said that 'in the present international tug of war, survival itself may depend upon making the most effective use of the nation's intellectual resources.' " Those words were of the pre-Sputnik era, and Pressey's use of the idea suggests that it had long been elevated to the level of common-sense truism—an old adage or bromide.

2. John Gardner also used the naturalist metaphor in *Excellence: Can We Be Equal and Excellent Too?* when he wrote: "Generally speaking, individuals whose gifts have been discovered and cultivated have been as chance outcroppings of precious rock, while the great reserves of human talent lay undiscovered below." Julian Stanley cites Thomas Gray's "Elegy Written in a Country Churchyard" (1751) which reads in part:

Full many a gem of purest ray serene
The dark unfathomed caves of ocean bear;
Full many a flower is born to blush unseen,
And waste its sweetness on the desert air.

The citation is, perhaps, unfortunate in that the obvious referent of the lines in the original poem is the group of "inhabitants" of a church graveyard. But, poetry out of context still can make a point, so long as we have fuzzy memories. Gardner cites what Thomas Jefferson said of his vision of the American educational system: "Geniuses will be raked from the rubbish." That metaphor, perhaps, is for another to employ, despite its color! Though the poetic and stylistic description of talent is itself interesting, I will now leave it to literary critics to explicate.

3. This descriptive tone has been attributed to Terman's own affable personality and administrative style (Gowan, 1977). Terman himself noted the tone of his researches, writing in his autobiography, "I am fully aware that my researches have not contributed very greatly to the theory of mental measurement" (Terman, 1932, p. 328).

4. Oden did report in 1968 that the most successful men of Terman's group came from families of high socioeconomic class, with higher levels of educational achievement, and a stable family structure. Moreover, the families of successful male "Termites" were more likely to support them financially and emotionally during years of academic and professional preparation.

5. Other significant longitudinal studies have been conducted by Julian C. Stanley and his colleagues at The John Hopkins University's Study of Mathematically Precocious Youth (SMPY), which was begun in 1971.

6. For instance, qualifying scores for applicants at the Rocky Mountain Talent Search are in the upper five percent (as opposed to the upper three percent) and, also at that search, students may be in the seventh or the eighth grade at the time they apply to the search. Duke's search was the first to use machine-readable application forms and to use computers throughout the operation—an innovation that has technically revolutionized the search concept. Now such forms are the rule rather than the exception, and machines have made extensive searches much more technically feasible than they were previously. Further, the Duke program has pioneered in using the ACT Assessment as an alternative means of identification.

7. Duke's Talent Identification Program accepts students who qualify on one of the following tests: Iowa Test of Basic Skills, California Achievement Test, Stanford Achievement Test, SRA Achievement Series, Comprehensive Test of Basic Skills, Metropolitan Achievement Test, Test of Cognitive Skills, ERB Comprehensive Testing Program, Comprehensive Assessment Program Achievement Series, Cognitive Abilities Test, Kentucky Essential Skills Test, Wechsler Intelligence Scale for Children-Revised (WISC-R), Secondary School Admissions Test, Developing Cognitive Abilities Test, Kuhlmann-Anderson Test, National Tests of Basic Skills, Otis Lennon School Ability Test, Peabody Individual Achievement Test, School and College Ability Tests, Sequential Tests of Educational Progress, STS Educational Development Series (ED Series), 3-R's Test (Achievement Test, Ability Test), Wide Range Achievement Test-Revised (WRAT-R).

References

- Bakeless, J. E. (1947). *Lewis and Clark: Pioneers in discovery*. New York: William Morrow.
- Boring, E. G. (1959). Lewis Madison Terman: 1877-1956. *Biographical Memoirs of the National Academy of Sciences* 33: 414-40.
- Clark, M. and Lewis, W. (1953). *The Journals of Lewis and Clark*, B. DeVoto (ed.). Boston: Houghton Mifflin Co.
- Gardner, J. W. (1961). *Excellence: Can we be equal and excellent too?* New York: Harper and Row.
- Getzels, J. W. (ed.) (1977). General discussion immediately after the Terman memorial symposium. In J. C. Stanley, W. C. George, and C. H. Solano (eds.), *The gifted and the creative: A fifty-year perspective*. Baltimore: The Johns Hopkins University Press.
- Gowan, J. C. (1977). Background and history of the gifted-child movement. In J. C. Stanley, W. C. George, and C. H. Solano (eds.), *The gifted and the creative: A fifty-year perspective*. Baltimore: The Johns Hopkins University Press.
- Janos, P. M. and Robinson, N. M. (1985). Psychosocial development in intellectually gifted children. In F. D. Horowitz and M. O'Brien (eds.), *The gifted and talented: Developmental perspectives*. Washington, D. C.: American Psychological Association.
- National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform*. Washington, D. C.: U. S. Government Printing Office.
- National Science Board Commission of Precollege Education in Mathematics, Science, and Technology. (1983). *Educating Americans for the 21st century*, 2 vols. Washington, D. C.: National Science Foundation.
- Oden, M. H. (1968). The fulfilment of the promise: 40-year follow-up of the Terman gifted group. *Genetic Psychology Monographs* 77: 3-93.
- Pressey, S. L. (1976). Concerning the nature and nurture of genius. In W. Dennis and M. W. Dennis (eds.), *The intellectually gifted: An overview*. New York: Grune and Stratton; rpt. from *Scientific Monthly* (1955) 81: 123-129.
- Stanley, J. C. (1974). Intellectual precocity. In J. C. Stanley, D. P. Keting, and L. H. Fox (eds.), *Mathematical talent: Discovery, description, and development*. Baltimore: The Johns Hopkins University Press.

- _____. (1977). Rationale of the Study of Mathematically Precocious Youth (SMPY) during its first five years of promoting educational acceleration. In J. C. Stanley, W. C. George, and C. H. Solano (eds.), *The gifted and the creative: A fifty-year perspective*. Baltimore: The Johns Hopkins University Press.
- Terman, L. M. (1932). Autobiography. In C. A. Murchison (ed.), *A history of psychology in autobiography*, vol. 2. Worcester, Mass.: Clark University Press.
- _____. and Oden, M. H. (1959). *The gifted group at mid-life: Thirty-five years follow-up of the superior child*. Stanford: Stanford University Press.
- U. S. Congress, Office of Technology Assessment. (June 1986). *Federal government information technology: Electronic record systems and individual privacy*. Washington, D. C.: U. S. Government Printing Office.

Discussant Reaction:
Purchase and Possession: A National Database for the
Scientifically, Mathematically and Technologically Talented

Robert J. Thompson

A discussant's role is difficult in that it involves trying to amplify some of the presenter's points, in a relatively short period of time, without being superfluous. Although the task can be difficult I approach this one with considerable enthusiasm because of the importance of the question and the effectiveness of Dr. Sawyer's paper in eliciting commitment to this area.

Dr. Sawyer informs us that his inspiration and motivation for his thoughts comes from a consideration of the Louisiana purchase. From that he derives his informing vision. The essence of a vision is a sharing with us of a view of what can be. The generation and effective communication of a vision is an essential component of leadership because it serves to elicit and motivate the commitment of personal and institutional resources.

Important in Dr. Sawyer's vision is the change from a reactive to an active approach to talent identification and development. This vision is based on a premise that we have a commitment to educate for future prosperity. Consistent with his metaphor of the Louisiana Purchase, Dr. Sawyer identifies that our expeditions will inform us and allow us to take possession of this area. What is essential here is a change from a haphazard harvest to a planned effort to increase the yield. Dr. Sawyer goes on to talk about the steps involved in such an effort, specifically that of the formation of a national data base. Dr. Sawyer addresses some of the difficulties in achieving this step such as addressing points of governance and coordination. In addition a modest beginning step of facilitating collaboration among two of the four current regional talent searches is suggested.

From my viewpoint what is important is that the national data base is necessary but not sufficient in and of itself to accomplish the vision that Dr. Sawyer has outlined. The national data base is not the endpoint, but an essential vehicle for accomplishing the goals of guiding the harvest and evaluating its yield.

The most critical elements in the formation of a national data base that will serve to actualize the vision of an active effort to develop talent are the expeditions. These will reflect and constitute the conceptual framework that will underlay the national data base. The expeditions can be seen as guided by a series of critical questions:

- What is the nature of this natural resource, talent, that we are searching for and endeavoring to foster?
- What are its component parts?
- How is it engendered?
- How much stability and change exist in this resource over time?
- How is it manifested at different phases in the life span?

- Is early identification warranted--is it wise? That is, what do we know about the impact of early identification?
- What is the best time to identify and for what purposes?
- What biological and psychosocial processes are associated with stability and change?
- What are the precursors, markers, and correlates within the individual and his/her family that are associated with talent?
- What challenges are necessary, and when, to stimulate development of commitment, leadership, and self-esteem?

The quality of the expedition will be a function of the extent to which the guiding questions are theoretically and empirically driven. There are a number of theoretical perspectives that are likely to be useful in looking back, and examining concurrent relationships, and in looking toward outcome.

Thus, to plan the expedition we need to know what to look for and where and when to look for it. To plan and accomplish these expeditions it is also necessary to elicit and maintain the commitment of scholars, practitioners, and policy makers who have been systematically considering the large question and/or some of its likely component parts. That is, we must bring talent to bare on these questions and that talent must be multidisciplinary including biomedical and behavioral perspectives. We need to be able to utilize University, foundation, and federal resources to promote the formation of a number of collaborative multidisciplinary, expeditionary groups.

I know from first hand experience of the hard work that is necessary to forget such genuinely collaborative multidisciplinary efforts. I also know from first hand experience of the rewards and satisfactions that can come from that process. There are other experiences that we can look to for guidance in this process. We have been successful in this country in establishing national collaborative projects such as the National Collaborative Infant Project in the early 1970's. In addition, foundations have considerable experience in putting together networks to address areas of interest.

Finally, I would like to conclude by saying that these working groups will be the necessary engines, fueled and renewed by the excitement of committed investigators pursuing meaningful questions, that will develop a national data base and use it to foster the development of the national resource of talent.

Discussant Reaction:
Purchase and Possession: A National Database for the
Scientifically, Mathematically and Technologically Talented

E. James Maxey

First, I'd like to thank Dr. Sawyer for his insightful comments. An important point that he made was the importance of a proactive effort in identifying and developing the potential of our country's talented young people. Too often, in the past few decades, the educational establishment has reacted in a sort of panic to the triumphs of other nations in areas such as space exploration and technology. The launch of Sputnik in 1957 shocked America into the realization that we were not number one in technology. We all recall the tremendous interest in the promotion of science and mathematics through the National Defense Education. Crisis solutions were proposed and, perhaps, their implementation begun; but too often, when the initial shock had worn off, these educational initiatives were abandoned. Money was made available to local school districts to improve the quality of instruction in math and science, textbooks were rewritten to introduce more modern concepts. Special textbooks were developed for biology, chemistry, and physics. New teaching aids were made available as well--calculators, slide rules, and new laboratories. This conference, I sincerely hope and believe, represents a new commitment to long-range educational goals: to seek out and nurture talent wherever it may be found, and to do this in the most effective way to provide opportunities for our young people to maximize their talents.

The concept of a national database that will enable researchers to examine the nature of talent and the ways in which talent may be encouraged and developed is one that I welcome and support. Dr. Sawyer has not underestimated the logistical difficulties of developing and using such a database.

In 1965 Dr. E. F. Lindquist, University of Iowa, developed the Card Pac system to collect and record academic development of all pupils in the elementary and secondary schools of Iowa. Test scores (ITBS and other measures of ability), courses taken, grades earned, and other teacher evaluations were collected on a yearly basis. The data were submitted by local schools on optical scan cards to the Iowa Educational Information Center (IEIC). IEIC was a non-profit organization developed by Lindquist to monitor the academic development of students, and the professional development of teachers. The optical scan data were processed by the Measurement Research Center (another test scoring business developed by Lindquist). Researchers and school officials were able to access the information available at IEIC to study issues related to

- Student achievement related to demographic characteristics
- Change in academic development over time
- Student/pupil ratios among schools
- Curriculum change
- Professional development of staff in the schools of Iowa

Lindquist had visions of such an information center being expanded to a national repository of important educational facts on students, faculty, and local schools.

The IEIC was certainly innovative, but the collection of the educational statistics on students, faculty, and institutions was very labor intensive. Local school officials cooperated but did not gain many immediate benefits. Collection of the data was very expensive, and after the three to five years of outside funding used to build the information center had ended, IEIC had to be significantly changed. Finally, the collection of such data ended about 1970-1971.

The process of collecting similar data today could be accomplished using microcomputer technology. It would be possible for local schools to submit data to a national information center on a floppy disc--using a prescribed format. By collecting information at the student level for children at grade six and above, it would be possible to help colleges, industry, and private research foundations identify pupils who could benefit from specific educational and work/research activities prior to finishing high school. Such activities would enable educators and industry to promote awareness activities among subgroups of the pupil population that currently do not seriously consider advanced education (minorities, children in rural areas, children from low income families). The highest professional standards must be maintained in ensuring the accuracy and usefulness of the data collected, in managing the technical aspects of data storage, and in monitoring the professional qualifications and ethics of those researchers and educators who will be allowed access to the data.

It might be desirable to establish such a database in a neutral location, not affiliated with any educational institution. Such a process would ensure that all educational institutions would have to meet the same standards for access to student information. The national repository of talent information on young people could be located in a nonprofit agency not connected to the federal government. The database on talent could be supervised by a board of professional educators from both the secondary and postsecondary levels.

Funding the national database on talented youth might be supported by private business and the philanthropy of private individuals. In addition, students might be asked to pay an initial fee to have talent information recorded in the database.

Both educational institutions and private industry might develop programs and services to motivate talented young people to explore educational career opportunities from grade seven through grade twelve. Such a program might enable business and industry to promote stronger awareness of opportunities for talented youth in highly technical fields. Educational experiences such as those now available at Duke and other universities might be made available within businesses such as IBM, General Motors, and AT&T. When these talented youth become old enough to hold jobs, businesses might promote learning and work opportunities for students during the academic school year as well as during the summer. Such efforts might provide greater awareness of the need for innovative improvements in all areas of technology.

Although I've been associated with a major testing company for almost my entire professional life, I've spent much of that time reminding educators and legislators that, while test scores can be a *convenient and valuable* source of information, we should not fall into the trap of assuming that they are the *only* source of information. I hope that future plans for research by the persons here today, and by others, will include studying the many different ways in which talent can be manifested and the different ways in which we can identify talented individuals. Perhaps we should think of the development of a national repository of information on young people talented in areas such as the fine arts, performing arts, athletics, mathematics, science, and technology.

Although this conference is focused on the special needs of our most academically talented young people, we need to keep in mind that all talents are valuable, and that all people, in one way or another, are talented. In a society such as our own, we have the resources to provide for the special needs of one group while also providing opportunities for those who may be less academically talented to develop their own skills to the fullest extent.